MathGAINS

CAMP

Facilitation of Mathematics Professional Learning

Collaborative Action Research:

Engaging in classroom research to deepen our knowledge of math and math teaching

Who we are…

Erin Jenkins is a Curriculum Consultant with Trillium Lakelands District School Board. She enjoys working collaboratively, planning district-wide professional learning in mathematics, including CIL-M and this year's Numeracy PD day for all board employees. Erin has a passion for learning how children develop their conceptual understandings in mathematics, and how educator practices can enhance learning for everyone. Erin lives in Oakwood, Ontario with her husband and two children.

Tara Flynn is Research Officer and Project Manager for Dr. Cathy Bruce at Trent University. Her interests focus on professional learning models that bridge research-practice gaps in mathematics education. She has worked extensively within the framework of collaborative action research as both a participant and facilitator, and sees collaborative action research as a powerful bridge between research and practice. Tara has worked with over 40 teams engaging in collaborative action research in mathematics education (with a range of specific content areas in including early geometry and fractions) and has written extensively on the subject with Cathy Bruce.

Graffiti: Collaborative Action Research

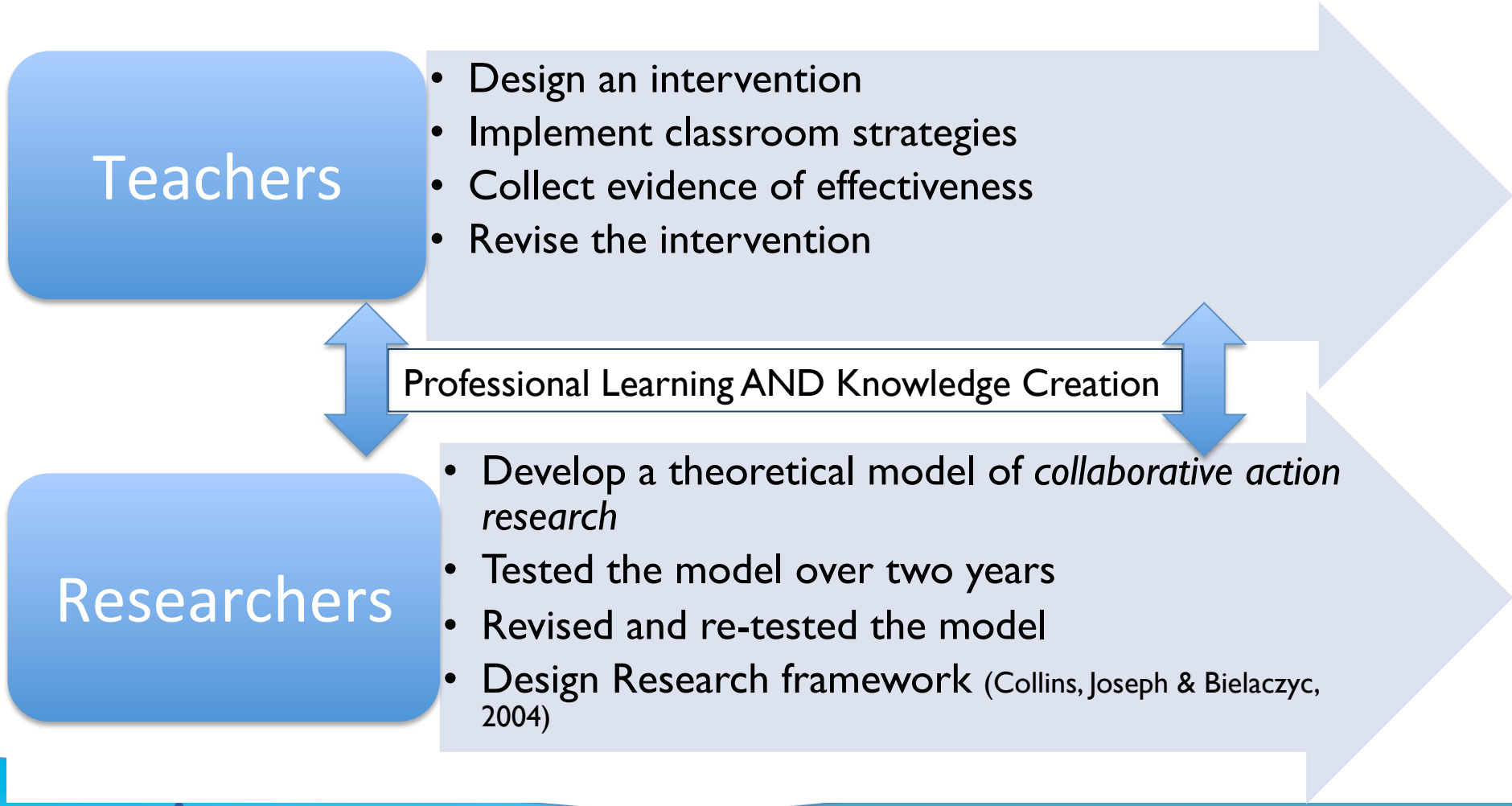
What do we know/believe about action research?

MathGAINS

Collaborative Action Research

- Refers specifically to action research conducted in partnerships that include teachers *and* researchers
- Enables teachers to closely examine issues of student learning and teacher practice
- Bruce, Ross & Flynn, 2010; Capobianco 2007

Two-layers of Collaborative Action Research

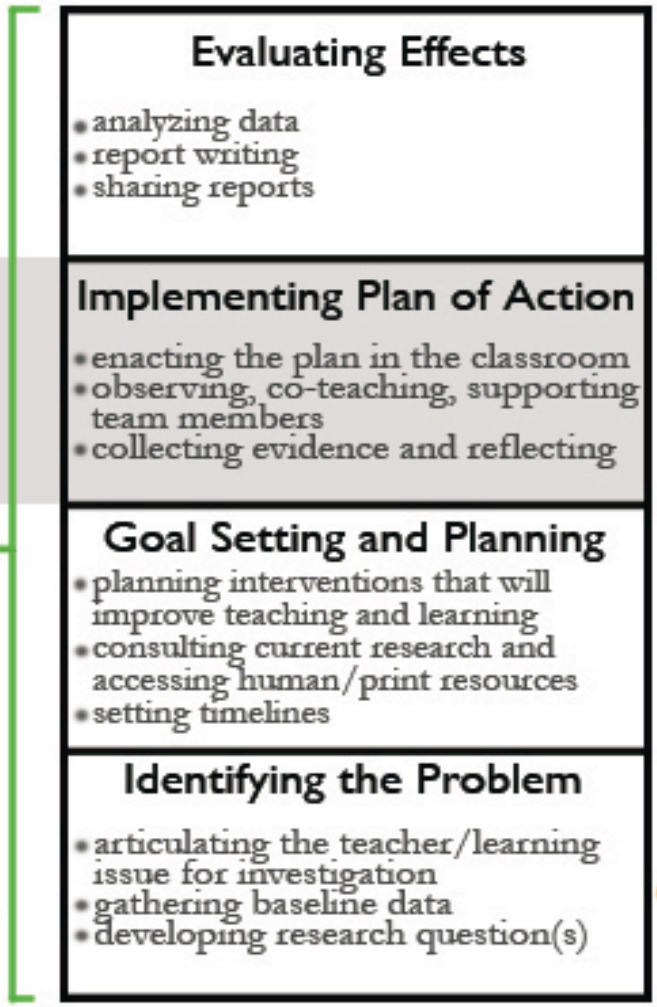


Collaborative Action Research

CLASSROOM

Collaboration

Throughout collaborative action research activity, teachers frequently meet to set goals, and to plan and engage in related interventions, data collection, data analysis and report writing. The involvement of researchers and knowledgeable others can range from full membership in the team to a supporting role (e.g., providing resources, assisting with data collection and analysis strategies).



Asking New Questions

The findings of collaborative action research often reveal other problems and lead to new questions that provide a springboard for a second cycle of action research in new or refined areas of study.

Data Collection and Analysis

MathGAINS

ETFO Teachers Learning Together Collaborative Action Research project:

- 3 years
- 17 teams in total in province of Ontario

Some Overall Results

MIXED METHODS STUDY

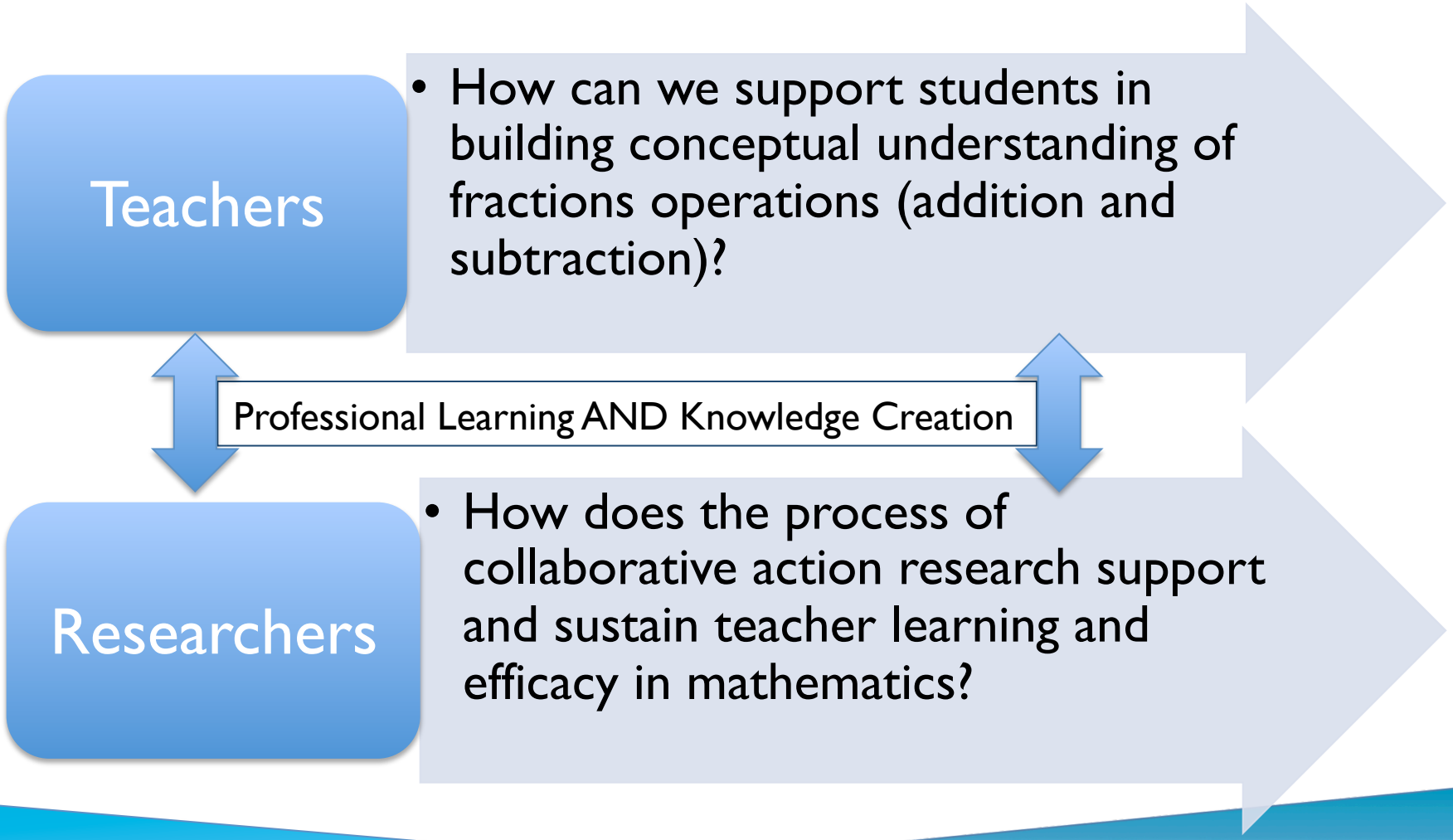
Pre-post survey data of 80 teachers involved in a (relatively) wide-scale collaborative action research project from 2007-2010 showed:

1: CAR contributed to improved teacher attitudes to the usefulness and relevance of research

2: CAR contributed to improved teacher efficacy in ability to engage students

Bruce, C., & Ross, J. (2013). "The Impact of Collaborative Action Research on Teachers' Professional Beliefs." In Teachers Learning Together: Lessons From Collaborative Action Research In Practice. Published by Elementary Teachers' Federation of Ontario.

Research Questions (example)



Data Sources

Data collection by the teachers:

- Teacher journal entries
- Student work samples (pre and post) including photographic evidence
- Records of observation
- Video footage (pre and post assessment tasks)

Data collection by the researchers:

- Teacher journal entries
- Transcripts of interviews
- Questionnaires
- Video footage (of planning sessions, focus lessons)
- Field notes
- Records of communication
- Final report

SOME ADDITIONAL CONSIDERATIONS: What does it look like?

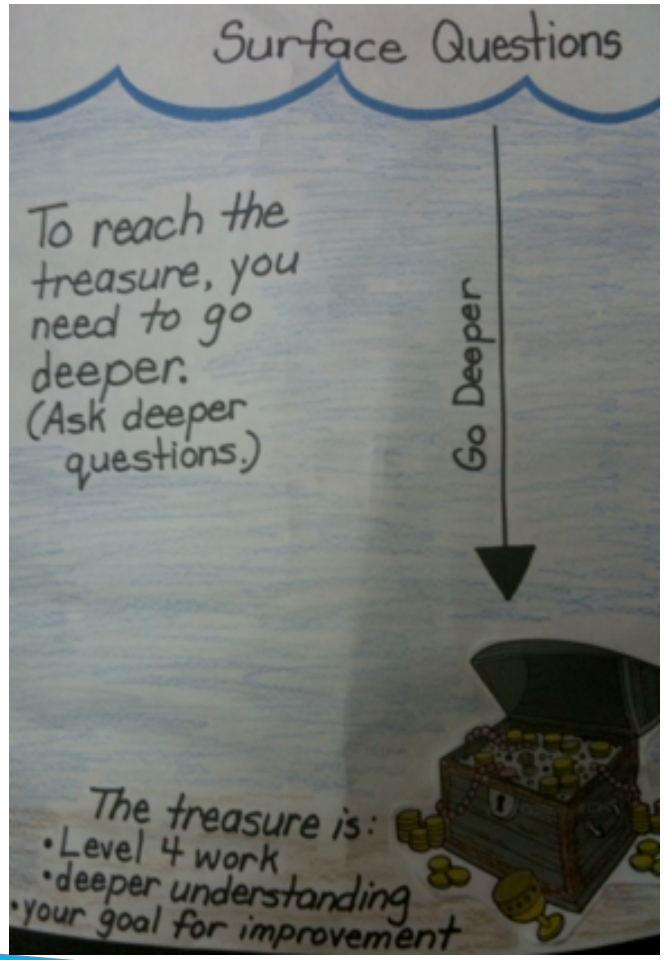
- size of group (8-10 max including central staff and research support as well as educators)
- Frequency and scope (one cycle per year, 2 months to 8 months)
- Other logistics (half days and monthly meetings to build and maintain momentum, implications for data collection and analysis, creative ways of involving researchers)

WHAT IS YOUR PROBLEM?

Process: get participants to articulate a problem that is relevant to their mathematics teaching practice…

THEN FRAME IT AS A QUESTION…..

??????????????????????????????



Collaborative Action Research on Effective Questioning in Mathematics

MathGAINS

Teachers set a research question around their goals…

We want to see in students:

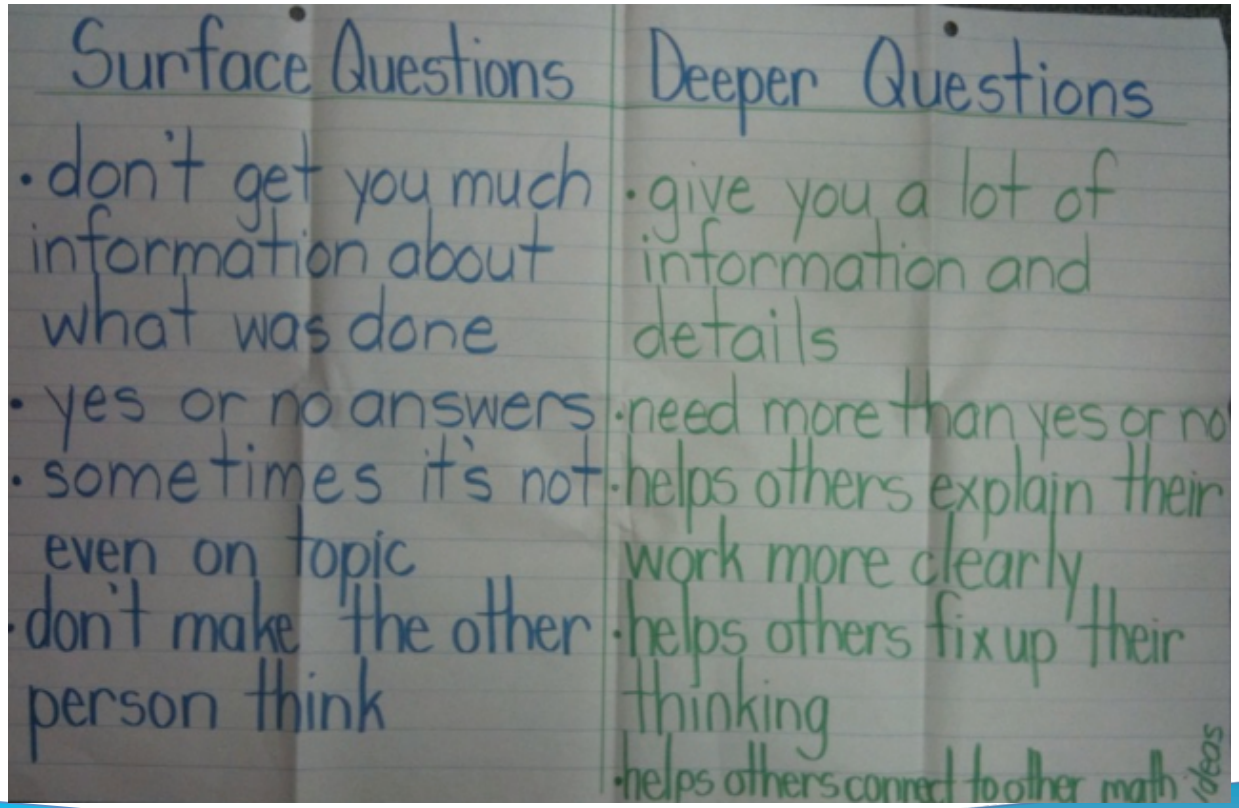
- Develop understanding of what a good question looks like in mathematics
- Independently ask high quality questions of their peers to further develop mathematical understanding

We want to see in ourselves:

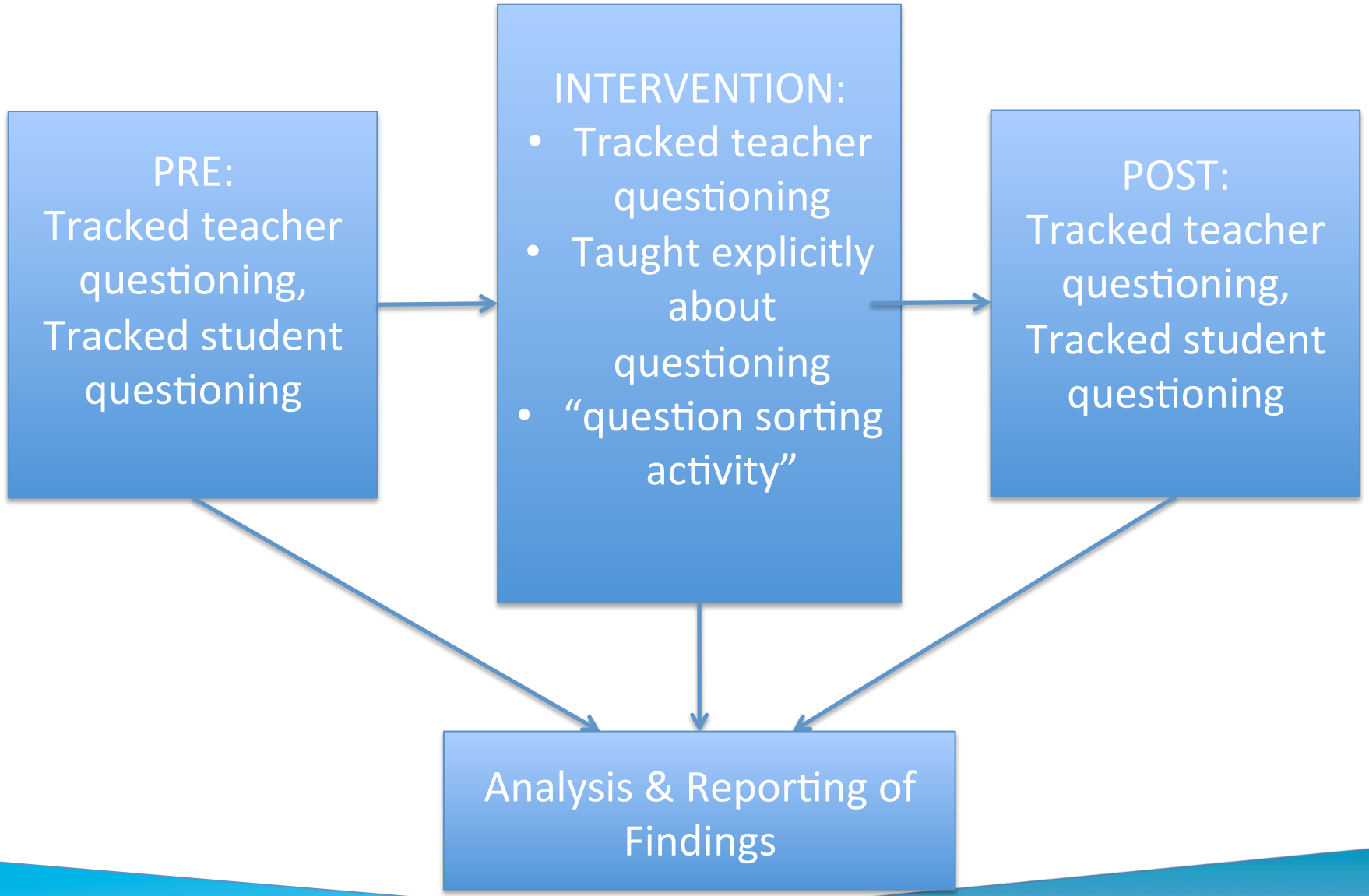
- Improved ability to ask probing questions that are meaningful
- Deepen student understanding of the mathematics through our questions
- Ability to use questions to make connections to previous learning

Research Question: How does a focus on questioning in mathematics affect teacher and student abilities to ask good questions during problem solving tasks?

Starting with the research: eg. productive vs. reproductive questions



MathGAINS


PRE:
Tracked teacher questioning,
Tracked student questioning
INTERVENTION:
• Tracked teacher questioning
• Taught explicitly about questioning
• "question sorting activity"
POST:
Tracked teacher questioning,
Tracked student questioning
Analysis & Reporting of Findings

Student data:

PRE

Category	Totals	Percentages
Surface	52/68	76%
Deeper	16/68	24%

POST

Category	Totals	Percentages
Surface	70/234	30%
Deeper	164/234	70%

Teacher data:

LESSON 1

Category	Totals	Percentages
Surface	51/68	75%
Deeper	17/68	25%

LESSON 2

Category	Totals	Percentages
Surface	52/101	51%
Deeper	49/101	49%

LESSON 3

Category	Totals	Percentages
Surface	51/163	31%
Deeper	112/163	69%

Our problem:

We notice a lack of supports for facilitators in the area of effective questioning. A lot of attention has been given to teacher questioning in recent years, resulting in a good understanding of effective questioning practice; the foundation and underlying principles of effective questioning applies to facilitation however the questions themselves don't directly translate to the facilitator context.

Our question:

What key questions can support facilitators in guiding learning – and all the things that facilitators do?

We are hoping you might help …by creating a repertoire of effective questions for facilitators

- Think of what you know about effective questioning practices.
- Think about the CODES – all the things that you do as facilitators and challenges you might encounter, what questions could you have in your "back pocket" for those situations?

Turn and talk…

- Please **record key questions** that might help in the context of **facilitating professional learning in mathematics.**

KEY QUESTIONS FOR FACILITATORS

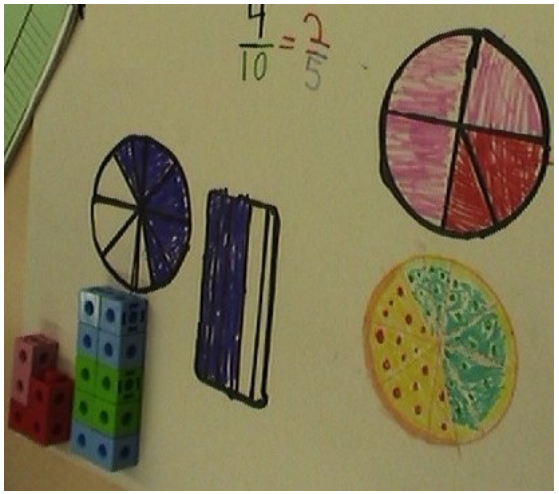
- Let's pool our knowledge – what questions have you recorded?

Let's look at another example of a collaborative action research project:

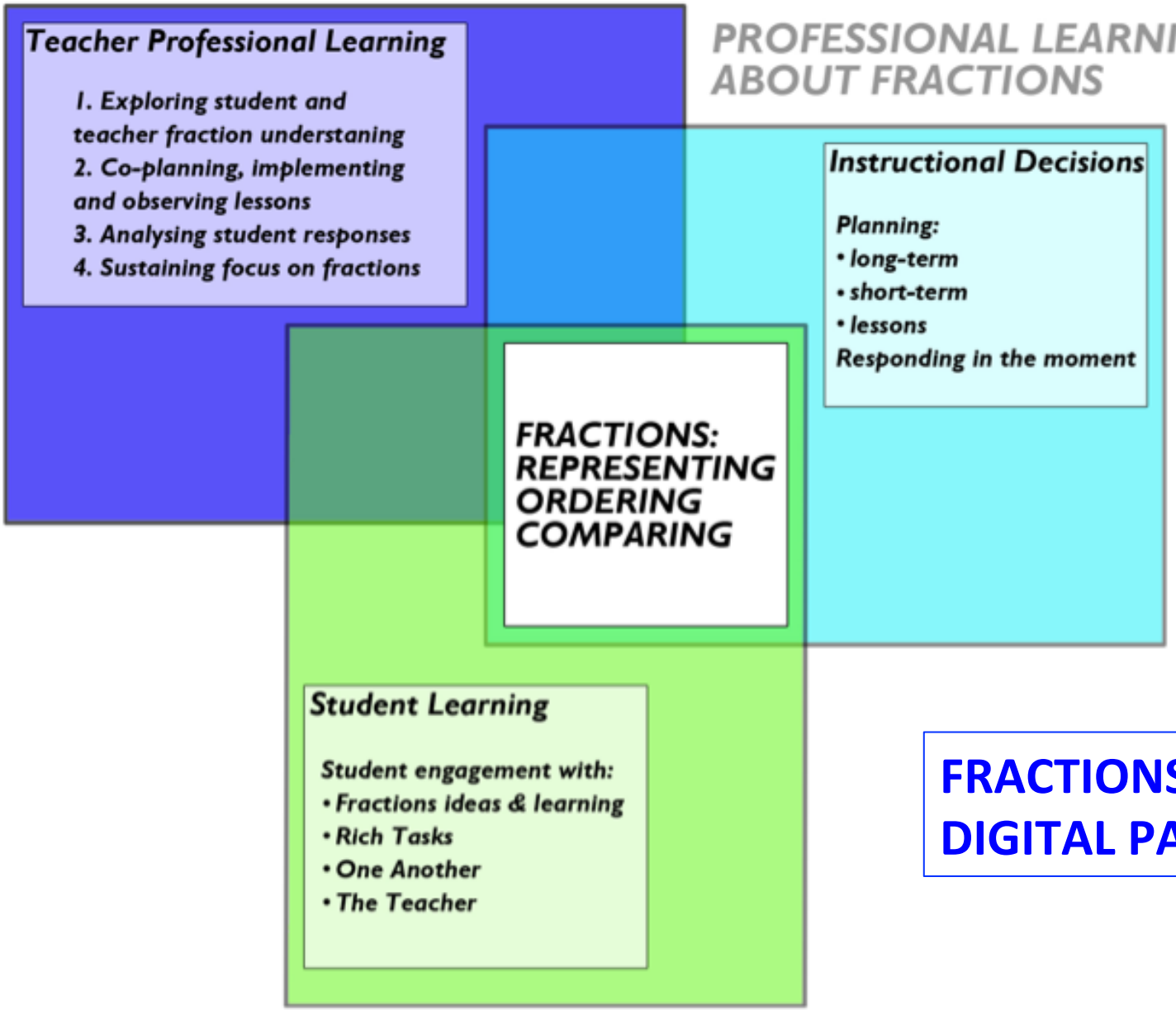
KNAER
Knowledge Network for Applied Education Research

RECRAE
Réseau d'échange des connaissances pour la recherche appliquée en éducation

Fractions



MathGAINS



FRACTIONS DIGITAL PAPER

MathGAINS

The Nature of our Collaborative Research Project

- Principal Investigator Dr. Cathy Bruce (Trent University)
- Research Lead Tara Flynn (Trent University)
- Ministry of Education Lead Shelley Yearley
- 2011-2012 – Representing, Comparing and Ordering
  - Kawartha Pine Ridge DSB
  - Ottawa Carleton DSB
  - Simcoe County DSB
- 2012-2013 – Representing, Comparing and Ordering
  - Simcoe Muskoka Catholic DSB (Problem Solving)
  - York Catholic DSB (Students with LD)
- 2012-2013 – Addition and Subtraction
  - Simcoe County DSB
  - Trillium Lakelands DSB

MathGAINS

Why fractions?

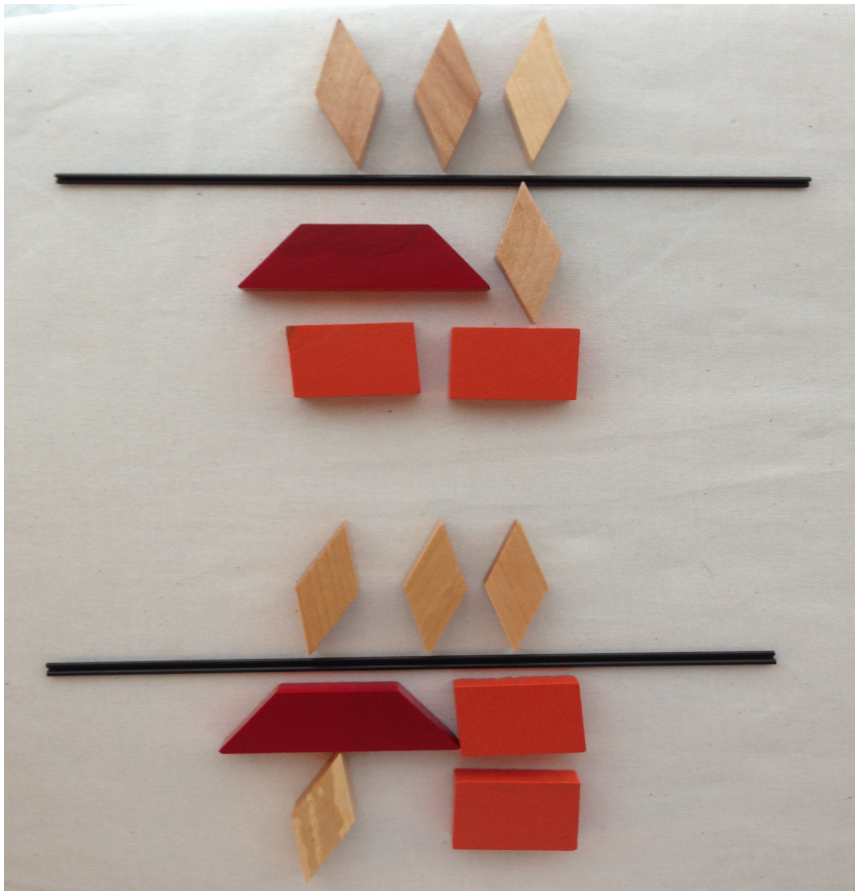
- Difficult to learn, difficult to teach
- Fractions misconceptions are a “serious obstacle to the mathematical maturation of children” (Behr, Harel, Post & Lesh)
- underpins many later areas of mathematics: proportional reasoning, spatial reasoning, algebraic reasoning as well as probability
- Essential to STEAM fields (Science, Technology, Engineering, Arts and Mathematics)

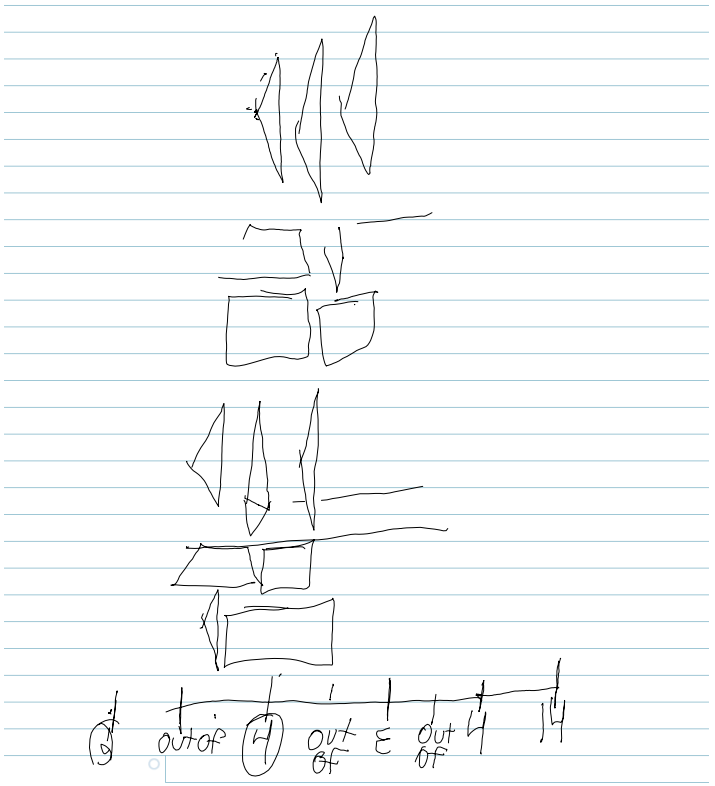
Chantal eats ¾ of a sandwich at lunch and ¾ of a sandwich after school.

How many sandwiches does Chantal eat in all?

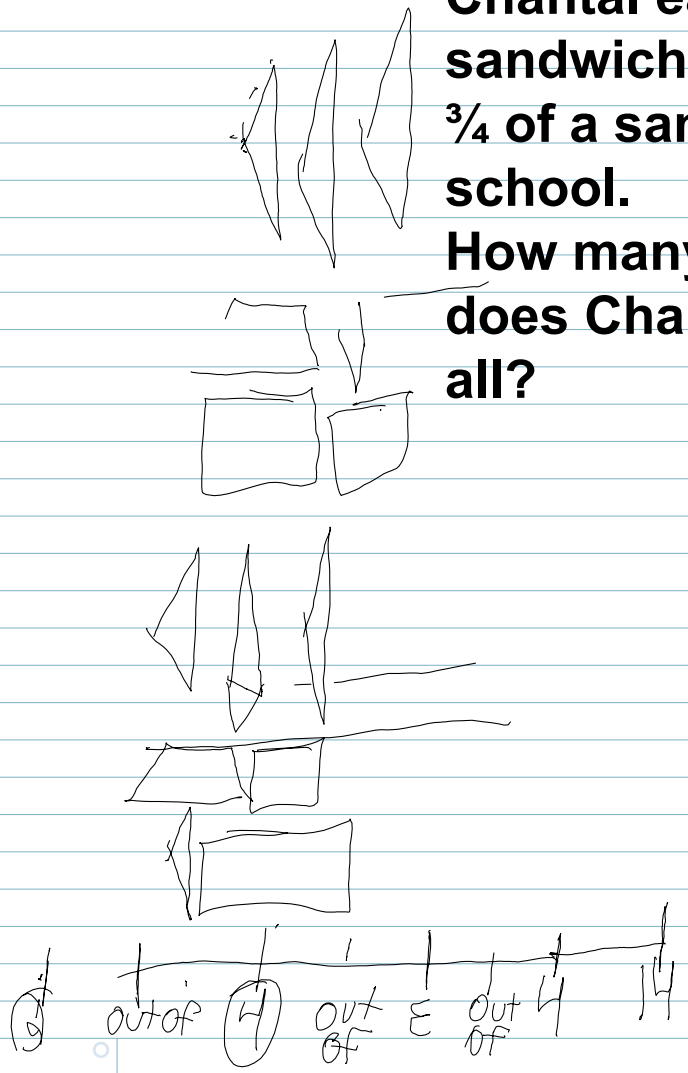
Nicolas' solution to: **Chantal eats ¾ of a sandwich at lunch and ¾ of a sandwich after school.**

How many sandwiches does Chantal eat in all?





Chantal eats ¾ of a sandwich at lunch and ¾ of a sandwich after school.
How many sandwiches does Chantal eat in all?



While we are watching Nicolas' solution, think about:

1.) what does Nicolas understand about fractions?

2.) What misconceptions does Nicolas hold?

3.) How are manipulatives helping or hindering him?

4.) What does Nicolas need?

MathGAINS

Two minutes, turn and talk…

1) What does Nicolas understand about fractions?

2) What misconceptions does Nicolas hold?

3) How are manipulatives helping or hindering him?

4) What does Nicolas need?

Back to Chantal and her sandwiches…

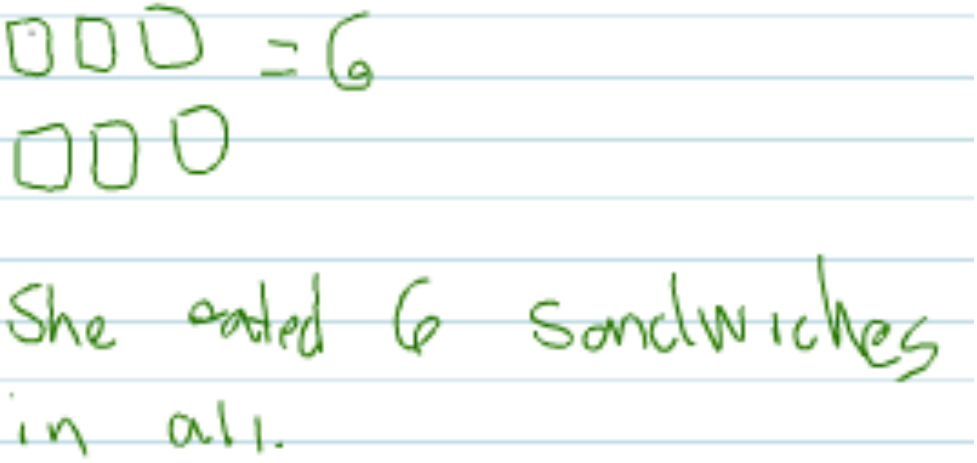
Chantal eats ¾ of a sandwich at lunch and ¾ of a sandwich after school.

How many sandwiches does Chantal eat in all?

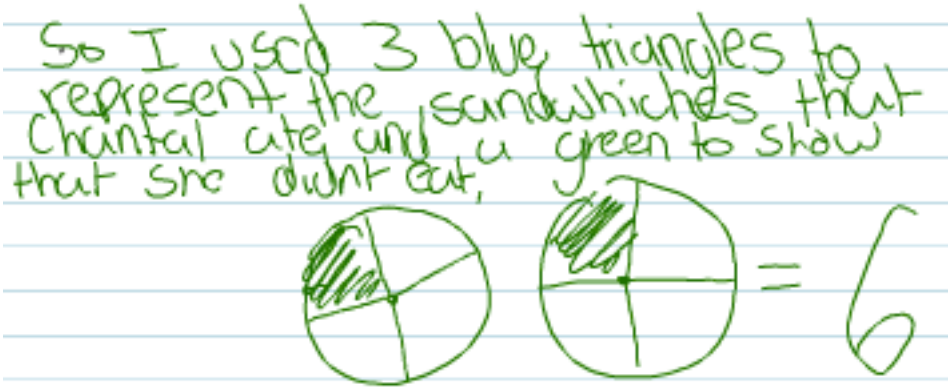
Use pictures/words and/or symbols to explain your answer.

We saw what Nicolas did…what are some other student solutions?

Alessia's representation of 4/5…



A typical solution…what is going on behind these misconceptions?



Facilitator Reflections…

- Revealing the process: what were some of our facilitator moves just now?
- Making sure participants have experiences in the learning and ESPECIALLY ENGAGING IN THE MATH! (Doing mathematics as the basis for a shared experience – can't emphasize the importance of this! ENGAGEMENT WILL BE HIGHER AND INSIGHTS DEEPER IF PARTICIPANTS DO THE PROBLEM BEFORE ANALYSING THE STUDENT WORK.)

STRENGTHS OF CAR

- High degree of teacher choice (by challenges that are directly relevant to daily teaching practice)
- Results in deep teacher learning
- Fosters an inquiry stance/learning stance
- Increases teacher efficacy
- Close attention to student thinking
- Grounded in research
- Can lead to the development of locally relevant supports

CONSTRAINTS OF CAR

- Resource-intensive
- Difficult to scale up
- Requires collaborative relationships with researchers (can be difficult to find researchers in your area who do this kind of work)

Challenge: Try a small action research project based on the key questions we have developed…

- PRE: Write a journal entry: how effective is your questioning practice as a facilitator? How confident do you feel in your ability to ask effective questions? Does your questioning practice move the group forward? (Think of a critical incident related to your questioning and write about it.)
- INTERVENTION: make a conscious effort to use the questions we have developed
- POST: Write another journal entry responding to the same prompts.
- Data analysis: Compare pre and post by coding based on predominant themes.

Consolidating the learning

How does the learning from this session impact:

- your next steps?
- your goal?
- how you will achieve your goal?

Thank you!

- tara.c.flynn@gmail.com

References/further reading:

- www.tmerc.ca